



PATENT  
0020-4864P

**IN THE U.S. PATENT AND TRADEMARK OFFICE**

In Re Application of

Before the Board of Appeals

Kazuhisa Fushihara

Appeal No.

Appl. No.: 09/854,693

Group: 3711

Filed: May 15, 2001

Examiner: R. Gordon

Conf. No.: 8117

For: FLOATABLE GOLF BALL FOR DRIVING RANGE

**APPEAL BRIEF ON BEHALF OF APPELLANTS UNDER**  
**37 C.F.R. §41.37**



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**MS APPEAL BRIEF - PATENTS**  
PATENT  
0789-0154P

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**37 C.F.R. §41.37**

**MS APPEAL BRIEF- PATENTS**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

March 2, 2005

Dear Sir:

This is an Appeal from the Final Rejection of June 3, 2004 of claim 1 in the above-identified application, the period for response having been extended one (1) month until March 2, 2005 (a Notice of Appeal having been filed on December 2, 2004).

**I. REAL PARTY IN INTEREST**

As evidenced by the Assignment filed August 9, 2001 and recorded at Reel 012058, Frames 0888-0890 the Real Party In Interest in connection with the present application is the Assignees of record: Sumitomo Rubber Industries, Ltd. 6-9 Wakinohama-cho 3-chome, Chuo-ku, Kobe-shi Hyogo-ken, Japan.

## **II. RELATED APPEALS AND INTERFERENCES**

There are no pending Appeals or Interferences related to the present application known to the Appellant or the Appellant's Legal Representatives.

### **III. STATUS OF CLAIMS**

Claim 1 is pending in the application. Claim 1 stands rejected.

#### **IV. STATUS OF AMENDMENTS**

An Amendment was filed on November 21, 2002. A Reply Under 37 C.F.R. § 1.116 was filed on August 4, 2003, which was entered by a Request for Continued Examination filed September 17, 2003. Following a non-final Office Action mailed October 21, 2003, a Request for Reconsideration was filed on March 19, 2004. An Amendment under 37 C.F.R. § 1.116 was filed on September 3, 2004 in response to the final Office Action mailed June 3, 2004. The Advisory Action mailed October 25, 2004 entered the Reply Under 37 C.F.R. § 1.116 for purposes of appeal.

Accordingly all of the amendments to the application have been entered and considered by the Examiner.

**V. SUMMARY OF CLAIMED SUBJECT MATTER**

The present invention pertains to a floatable golf ball for a driving range, which possess excellent durability and good shot feel (page 3, lines 7-9, paragraph [0006]). The inventive golf ball has a core and a cover covering the core (page 3, lines 22-24, paragraph [0008]), where the cover has a flexural modulus (F) of 80 to 300 Mpa (page 3, lines 22-25 to page 4, line 1, paragraph [0008]). The golf ball has a specific gravity of not less than 0.5 and less than 1.0, and a deformation amount (D) of 3.0 to 6.0 mm when applying from an initial load of 98 N to a final load of 1275 N (page 4, lines 2-5, paragraph [0008]). Also, a ratio (F/D) of the flexural modulus of the cover (F) to the deformation amount of the golf ball (D) is within the range of 24 to 31 (page 6, line 23 to page 7, line 5, paragraph [0013]).



**VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

The sole issue presented for review is whether Yoshimasa et al. (JP 06-327791) suggests all of the elements of claim 1 to support an obviousness rejection under 35 U.S.C. § 103(a).

## VII. ARGUMENT

### A. Claim 1

Yoshimasa et al. fails to suggest all of the elements set forth in claim 1 properly support a rejection under 35 U.S.C. §103.

#### ***A.1. The Present Invention and its Advantages***

The present invention is directed to a floatable golf ball for use in a driving range, which possesses excellent durability, and good shot feel.

In golf balls utilized in driving ranges, it is required for such golf balls to possess substantially the same performance qualities as golf balls that are utilized for playing a normal round of golf. Also, it is advantageous if the golf balls used in driving ranges are floatable, since many driving ranges face water-hazards in order to recreate water hazards which might be normally experienced in a round of golf.

The present invention finds a typical embodiment in claim 1:

1. A floatable golf ball for a driving range comprising a core and a cover covering the core, wherein
  - the cover has a flexural modulus (F) of 80 to 300 Mpa,
  - the golf ball has a specific gravity of not less than 0.5 and less than 1.0, and a deformation amount (D) of 3.0 to 6.0 mm when applying from an initial load of 98 N to a final load of 1275 N, and

a ratio (F/D) of the flexural modulus of the cover (F) to the deformation amount of the golf ball (D) is within the range of 24 to 31.

Tables 5 and 6 from pages 24 and 25 of the specification, which are reproduced below, demonstrate the excellent results obtained by the inventive floating golf balls.

**Table 5**

| Test item                        | Example No. |       |       |       |       |
|----------------------------------|-------------|-------|-------|-------|-------|
|                                  | 1           | 2     | 3     | 4     | 5     |
| Flexural modulus of cover F(MPa) | 100         | 100   | 100   | 85    | 170   |
| Ball compression D(mm)           | 4.0         | 3.2   | 5.5   | 3.6   | 3.4   |
| Ratio (F/D)                      | 25          | 31    | 18    | 24    | 50    |
| Ball specific gravity            | 0.957       | 0.957 | 0.957 | 0.957 | 0.957 |
| Durability                       | 141         | 144   | 100   | 137   | 128   |
| Shot feel <sup>1</sup>           | o           | o     | o     | o     | o     |

---

<sup>1</sup> o : The golfers felt that the golf ball has small impact force, and good shot feel; Δ : The golfers felt that the golf ball has fairly good shot feel; x : The golfers felt that the golf ball has large impact force, and poor shot feel.

**Table 6**

| Test item                        | Comparative Example No. |       |       |       |       |
|----------------------------------|-------------------------|-------|-------|-------|-------|
|                                  | 1                       | 2     | 3     | 4     | 5     |
| Flexural modulus of cover F(MPa) | 40                      | 320   | 100   | 100   | 225   |
| Ball compression D(mm)           | 3.8                     | 4.2   | 2.8   | 6.2   | 3.1   |
| Ratio (F/D)                      | 11                      | 76    | 36    | 16    | 73    |
| Ball specific gravity            | 0.957                   | 0.957 | 0.957 | 0.957 | 0.957 |
| Durability                       | 85                      | 84    | 123   | 72    | 94    |
| Shot feel                        | ○                       | ○     | ×     | ○     | Δ     |

As is apparent from Tables 5 to 6, the golf balls of the present invention of Examples 1 to 5 have a specific gravity of less than 1.0, and float on water. In addition, the golf balls have good shot feel and excellent durability and put as compared with the conventional golf balls of Comparative Examples 1 to 5.

#### **A.2 Distinctions of the Invention Over Yoshimasa et al.**

Yoshimasa et al. pertains to a two-piece floatable golf ball that has a low specific gravity and floats on water. Yoshimasa et al. is mentioned in paragraph 0004 at page 2 of the specification, and typifies the conventional art discussed in paragraph [0005] pages 2 and 3 of the specification.

Yoshimasa fails to disclose or suggest a ratio (F/D) of the flexural modulus of the cover (F) to the deformation amount of the golf ball (D) is within the range of 24 to 31, as is set forth in claim 1 of the invention. "[A]ll the claim limitations must be taught or suggested by the prior art." In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All the words of a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Also, Yoshimasa et al. typifies the conventional art and its associated disadvantages. These disadvantages of hardness and poor shot feel are discussed in paragraph 0005 at pages 2-3 of the specification:

However, the golf ball for round games has possessed very soft and good shot feel and high rebound characteristics by the recent remarkable improvement of performance of the golf ball. Therefore the two-piece floatable golf ball for water-facing driving ranges was evaluated to have good shot feel when it was proposed, but such a conventional golf ball for driving ranges does not agree with requirement for the existing golf ball. It is problem that the conventional golf ball for driving ranges is very hard and has poor shot feel, because the core is hard and stiffness of the cover is too high.

When a rejection is based on 35 USC §103, what is in issue in such a rejection is "the invention as a whole," not just a few features of the claimed invention. Under 35 U.S.C. §103, "[a] patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art

are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." The determination under §103 is whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. See In re O'Farrell, 853 F.2d 894, 902, 7 USPQ2d 1673, 1680 (Fed. Cir. 1988). In determining obviousness, the invention must be considered as a whole and the claims must be considered in their entirety. See Medtronic, Inc. v. Cardiac Pacemakers, Inc., 721 F.2d 1563, 1567, 220 USPQ 97, 101 (Fed. Cir. 1983).

In rejecting claims under 35 USC 103, it is incumbent on the examiner to establish a factual basis to support the legal conclusion of obviousness. See, In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one of ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal Inc. v. F-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988), cert denied, 488

U.S. 825 (1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert denied, 475 U.S. 1017 (1986); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the examiner are an essential part of complying with the burden of presenting a *prima facie* case of obviousness. Note, In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). The mere fact that the prior art may be modified in the manner suggested by the examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be suggested or taught by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1970). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Also, the Examiner alleges obviousness over a single reference of Yoshimasa et al.

If a reference needs to be modified to achieve the claimed invention “there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness

conclusion." Sibia Neurosciences Inc. v. Cadus Pharmaceutical Corp., 225 F.3d 1349, 55 USPQ2d 1927 (Fed. Cir. 2000).

Further, the rigorous burden placed upon the Examiner for establishing *prima facie* obviousness has been emphasized by the United States Court of Appeals for the Federal Circuit in In re Sang Su Lee, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002). In Sang Su Lee, the court states:

As applied to the determination of patentability *vel non* when the issue is obviousness, "it is fundamental that rejections under 35 U.S.C. §103 must be based on evidence comprehended by the language of that section." In re Grasselli, 713 F.2d 731, 739, 218 USPQ 769, 775 (Fed. Cir. 1983). The essential factual evidence on the issue of obviousness is set forth in Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966) and extensive ensuing precedent. The patent examination process centers on prior art and the analysis thereof. When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. See, e.g., McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the Graham factors).

The need for specificity pervades this authority. See, e.g., In re Kotzab, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed"); In re Rouffet, 149 F.3d 1350, 1359, 47



USPQ2d 1453, 1459 (Fed. Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious."); In re Fritch, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (the examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references"). In re Sang Su Lee, at 277 F.3d at 1342.

As a result, one having ordinary skill in the art would not be motivated by the teachings of Yoshimasa et al. to produce the a golf ball having the claimed F/D range of 24-31. That is, the Examiner has failed produce a specific teaching in the prior art that points to the claimed F/D range of 24-31. A *prima facie* case of obviousness has thus not been made. Further, even if *prima facie* obviousness could be alleged, the invention shows unexpected results that offer full rebuttal.

Unexpected Results

As mentioned above, the Inventor has discussed the disadvantages of the

Yoshimasa et al. technology in the specification. That is, the inventor has recognized the golf ball of Yoshimasa et al. as being a golf ball having the above-described problems (discussed at paragraph [0005] of the specification) at the time of filing of the present application. In contrast, the golf ball of the present invention has excellent durability while maintaining soft and good shot feel by adjusting the  $F/D$  value to the range of 24 to 31, even if the flexural modulus ( $F$ ) of the cover is low.

In the Reply filed March 19, 2004, Figures A and B (see Evidence Appendix B) were presented to show unexpected results highlighting the fundamental differences between the invention and the conventional art typified by Yoshimasa et al. Figures A and B are reproduced below.

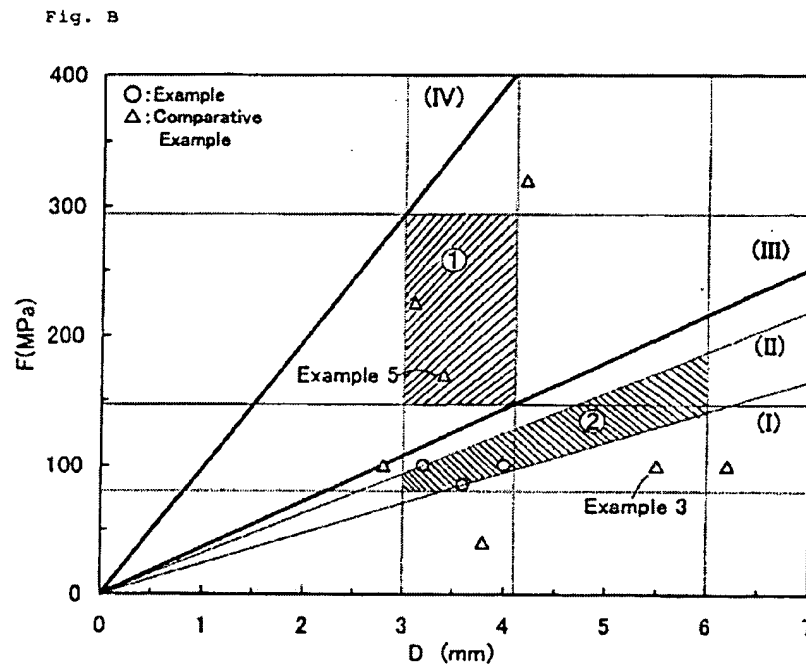
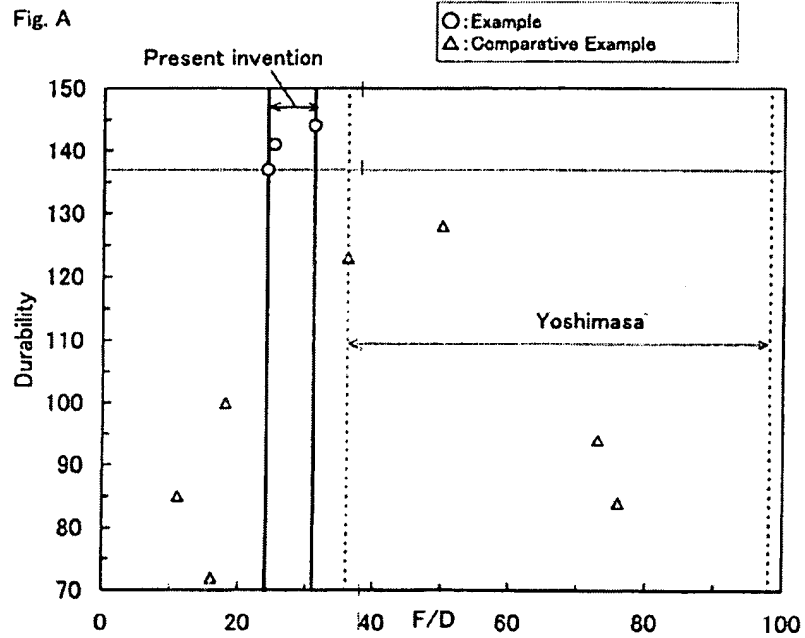


Figure A shows a graph displaying the relationship between the F/D value (x-axis) and the durability (y-axis) shown in Tables 5 and 6 at pages 24 and 25 of the specification. However, Example 3 having an F/D value of 18 and Example 5 having an F/D value of 50 are shown as Comparative Examples. The F/D values of the present invention are within the range of 24 to 31, and the F/D values of Yoshimasa et al. are within the range of 36 to 98. As shown in Figure A, the golf ball having the F/D value range of 24 to 31 has a durability of not less than 137, but the golf ball having the F/D value range of 24 to 31 has a durability of not more than 128.

Thus, the subject matter of Table 5 of the specification as shown in Fig. A clearly shows that the durability of the golf ball with a F/D value within the range of 24-31 is excellent, whereas the durability of the golf ball of the Yoshimasa et al. reference having a F/D value out of the range of 24-31 is much poorer. Thus, Fig. A clearly shows the advantageous results achieved by the present invention, which utilizes a F/D ratio within the range of 24-31. For the Board's consideration, the Appellant is also enclosing a copy of an English translation of the Tables and Footnotes of the Yoshimasa et al. reference (already of record in the application) in Appendix B.

Therefore, the inventive golf ball has excellent durability when the F/D value is within the range of 24 to 31. Since the golf ball of Yoshimasa et al. has

an F/D value out of the range of 24 to 31, the durability is much poorer than that of the present invention.

Further, Figure A in particular shows excellent results for durability that lie to the left of the F/D peak of the Comparative Examples' Gaussian curve. That is, a person having ordinary skill using the teachings of Yoshimasa et al. would see the durability decrease as the F/D decreases from 50, and as a result, would have no motivation to further reduce the F/D value to attain the elevated durability results of the invention. Thus, the invention represents a true unexpected result over Yoshimasa et al.

Figure B further elucidates the fundamental differences between the invention and Yoshimasa et al. The F/D value of Yoshimasa et al. (area ① shown in Figure B) is different from the F/D value of the present invention (area ② shown in Figure B), ***even if both golf balls have the same value of F or D.*** Therefore, the golf ball of Yoshimasa et al. having an F/D range of the present invention's range is quite different from the golf ball of the present invention.

*"Obvious To Try"*

Further, at page 2 of the Office Action of June 3, 2004, the Examiner asserts that since the specification discloses an overall range of F/D=15 to 50 (specification at page 4, lines 6-8), that it would be "an obvious modification" to

utilize the claimed F/D ratio of 24 to 31. However, the Examiner chooses to ignore the discussion in paragraph 0013 at pages 6 and 7 of the specification, which points out the advantages of the preferred ranges:

The present inventors have noticed a ratio (F/D) of the flexural modulus of the cover F (MPa) to the deformation amount of the golf ball when applying from an initial load of 98 N to a final load of 1275 N (D), which has not been noticed. They have discovered that the shear strain is small by adjusting the ratio (F/D) to not more than 50 in case of the golf ball having large deformation amount (D), and the durability is improved. When the ratio (F/D) is larger than 50, only the cover is too hard and stress applied to the core is large, and the core is easy to cut. In addition, the deformation of the cover is too small for large deformation amount of the golf ball, and the shear strain between the cover and core is large. Thus the cover is easy to cut, and the durability is degraded. Therefore it is desired for the ratio (F/D) to be within the range of not more than 50, preferably not more than 40, more preferably no more than 35, most preferably not more than 31. When the ratio (F/D) is too small, the cover is soft, and the durability of the cover is degraded. Therefore it is desired for the ratio (F/D) to be within the range of not less than 15, preferably not less than 18, more preferably no less than 24.

As a result, the Yoshimasa et al. does teach away from the invention, in contrast to the Examiner's assertion at page 3, lines 10-12 of the Office Action of June 3, 2004. It is improper to combine references where the references teach away from their combination. In re Grasselli, 713 F.2d 731, 218 USPQ 769, 779 (Fed. Cir. 1983).

Also, the Examiner is utilizing an improper "obvious to try" rationale.

The admonition that 'obvious to try' is not the standard under 103 has been directed mainly at two kinds of error. In some cases, what would have been 'obvious to try' would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful . . . . In others, what was 'obvious to try' was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it. In re O'Farrell, 853 F.2d 894, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988) (citations omitted) (The court held the claimed method would have been obvious over the prior art relied upon because one reference contained a detailed enabling methodology, a suggestion to modify the prior art to produce the claimed invention, and evidence suggesting the modification would be successful.). See also In re Eli Lilly & Co., 902 F.2d 943, 14 USPQ2d 1741 (Fed. Cir. 1990) and In re Ball Corp., 18 USPQ2d 1491 (Fed. Cir. 1991).

In this case, the Examiner has failed to point out where Yoshimasa et al. contained a detailed enabling methodology, or a suggestion to modify the prior art to produce the claimed invention.

A person having ordinary skill in the art would therefore not be motivated to produce the invention as embodied in claim 1 by Yoshimasa et al.

Accordingly, a *prima facie* case of obviousness has thus not been made. The invention also displays unexpected results over Yoshimasa et al.

### **A.3 *Summary***

The invention produces a truly novel floating golf ball having an F/D value of 24-31. As has been shown, the Examiner has failed to establish a *prima facie* case of obviousness over Yoshimasa et al. Even if obviousness could be alleged, this obviousness would be fully rebutted by unexpected results.

Accordingly, reversal of the Examiner's rejection of claim 1 based on the above arguments is respectfully requested.

### **C. *Conclusion***

The Appellant has demonstrated that the Examiner has failed to successfully allege that the rejected claims are *prima facie* obvious. It is clear that the inventive golf ball represents a truly inventive way to achieve a floating golf ball that is both durable and has good shot feel. For the reasons advanced above, it is respectfully submitted that claim 1 in this application is allowable. Thus, favorable reconsideration and reversal of the Examiner's rejection of claim 1 under 35 U.S.C. §103, by the Honorable Board of Patent Appeals and Interferences, are respectfully solicited.

The required Appeal Brief fee in the amount of \$500.00 is attached hereto.



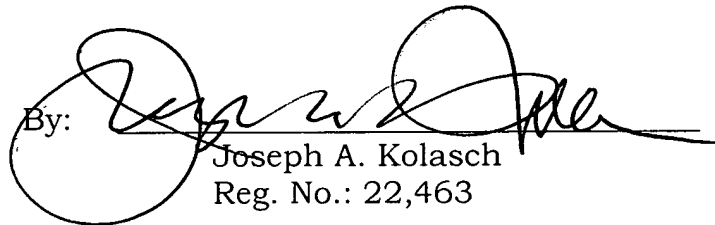
Pursuant to 37 C.F.R. §§ 1.17 and 1.136(a), Applicant(s) respectfully petition(s) for a one (1) month extension of time for filing a reply in connection with the present application, and the required fee of \$120.00 is also attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and further replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fee required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By:



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Attachment: APPENDIX A  
APPENDIX B

**APPENDIX A**

**CLAIMS APPENDIX**

1. (Previously Presented) A floatable golf ball for a driving range comprising a core and a cover covering the core, wherein

the cover has a flexural modulus (F) of 80 to 300 Mpa,

the golf ball has a specific gravity of not less than 0.5 and less than 1.0, and a deformation amount (D) of 3.0 to 6.0 mm when applying from an initial load of 98 N to a final load of 1275 N, and

a ratio (F/D) of the flexural modulus of the cover (F) to the deformation amount of the golf ball (D) is within the range of 24 to 31.

2. (Cancelled)

Appeal Brief filed March 2, 2005

Appl. No.: 09/854,693  
Group: 3711

**APPENDIX B**

**EVIDENCE APPENDIX**

Fig. A

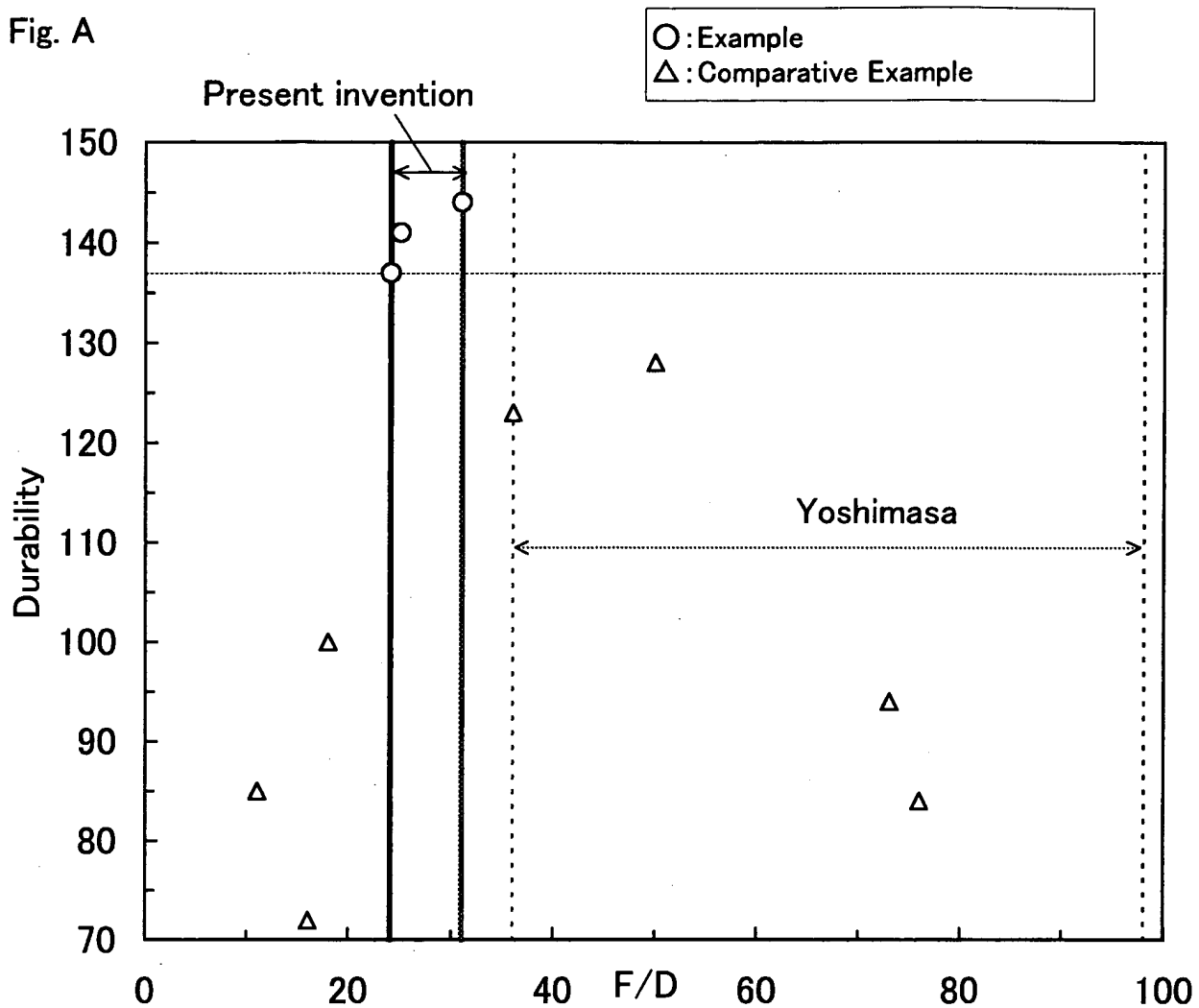
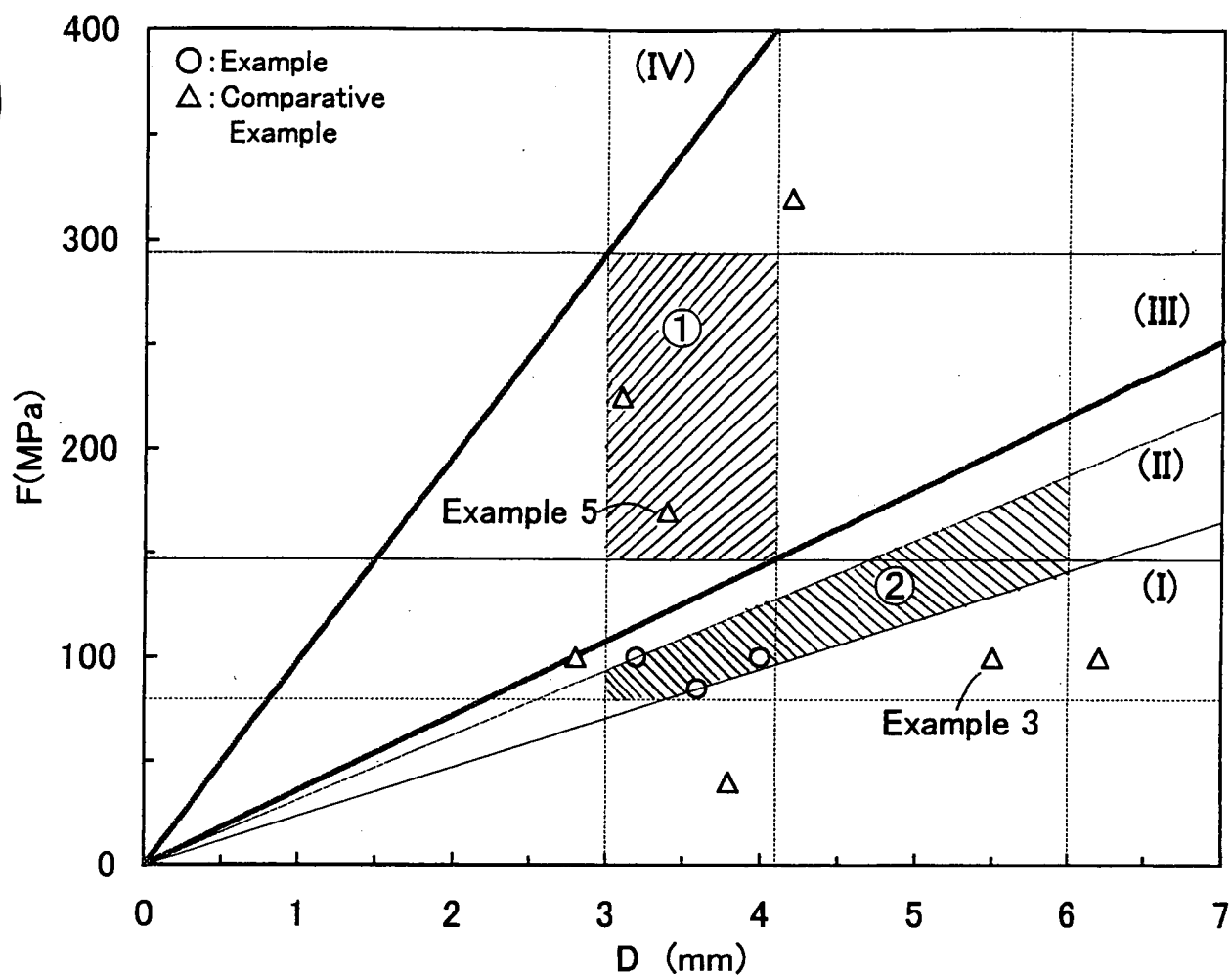


Fig. B





# Yoshimasa reference Table

Table 1

|                                 | Example No. |        |        |        |
|---------------------------------|-------------|--------|--------|--------|
|                                 | 1           | 2      | 3      | 4      |
| JSR BR11 *1                     | 60          | 60     | 60     | 60     |
| VCR412 *2                       | 40          | 40     | 40     | 40     |
| Mipelon XM-220 *3               | 15          | 15     | 15     | 15     |
| High-styrene resin *4           | 13          | 13     | 13     | 13     |
| Zinc oxide                      | 12          | 12     | 12     | 11.4   |
| Hollow particulate *5           | 20          | 20     | 20     | 20     |
| Zinc acrylate                   | 0           | 0      | 0      | 30     |
| Methacrylic acid                | 12          | 12     | 12     | 0      |
| Dicumyl peroxide                | 1.5         | 1.9    | 1.9    | 2.2    |
| Vulcanization condition(°C×min) | 155×30      | 155×24 | 155×24 | 160×20 |
| Physical properties of core     |             |        |        |        |
| Weight(g)                       | 28.5        | 28.5   | 28.5   | 28.6   |
| Compression(mm)                 | 3.7         | 3.5    | 3.5    | 3.6    |
| Hardness distribution (JIS-C)   |             |        |        |        |
| Center point                    | 66.5        | 72.5   | 72.5   | 65.5   |
| 5mm from center point           | 70.0        | 74.5   | 74.5   | 68.0   |
| 10mm from center point          | 71.0        | 75.5   | 75.5   | 69.0   |
| 15mm from center point          | 73.0        | 76.5   | 76.5   | 78.0   |
| Surface                         | 74.0        | 77.0   | 77.9   | 80.0   |

Table 2

|                                    | Comparative<br>Example No. |            |            |
|------------------------------------|----------------------------|------------|------------|
|                                    | 1                          | 2          | 3          |
| JSR BR11 *1                        | 60                         | 60         | 60         |
| VCR412 *2                          | 40                         | 40         | 40         |
| Mipelon XM-220 *3                  | 15                         | 15         | 15         |
| High-styrene resin *4              | 13                         | 13         | 13         |
| Zinc oxide                         | 12                         | 11.5       | 12.4       |
| Hollow particulate *5              | 20                         | 20         | 20         |
| Zinc acrylate                      | 0                          | 0          | 0          |
| Methacrylic acid                   | 12                         | 20         | 20         |
| Dicumyl peroxide                   | 1.5                        | 1.6        | 1.9        |
| Vulcanization<br>condition(°C×min) | 155×<br>30                 | 169×<br>20 | 169×<br>32 |
| Physical properties of core        |                            |            |            |
| Weight(g)                          | 28.5                       | 28.5       | 28.5       |
| Compression(mm)                    | 3.7                        | 2.5        | 2.4        |
| Hardness distribution (JIS-C)      |                            |            |            |
| Center point                       | 66.5                       | 73.0       | 73.0       |
| 5mm from center point              | 70.0                       | 75.0       | 75.0       |
| 10mm from center point             | 71.0                       | 77.0       | 80.0       |
| 15mm from center point             | 73.0                       | 80.0       | 84.0       |
| Surface                            | 74.0                       | 83.0       | 86.0       |

\*1: Cis-1,4-polybutadiene rubber, which is commercially available from JSR Co., Ltd. under the trade name of "BR-11" (Content of 1,4-cis-polybutadiene: 96 %)

\*2: Polybutadiene rubber containing syndiotactic-1,2-polybutadiene of 12 % by weight, cis-1,4-polybutadiene of 86 % by weight and trans-1,4-polybutadiene of 2 % by weight, which is commercially available from Ube Industries, Ltd. under the trade name of "UBEPOL-VCR412"

\*3: Fineparticle high molecular weight polyolefin powder, which is commercially available from Mitsui Chemicals, Inc. under the trade name of "Mipelon XM-220" (average particle diameter: 20  $\mu$ m, molecular weight: not less than 2 millions)

\*4: High-styrene resin, which is commercially available from Nippon Zeon Co., Ltd. under the trade name of "Nipol 2007J"

\*5: Hollow particulate of soda-lime borosilicate glass having a pressure resistance of 69 MPa and an average particle density of 0.60 g/cc, which is commercially available from Sumitomo 3M, Ltd.



Table 3

|                                          | Cover composition |      |      |      |
|------------------------------------------|-------------------|------|------|------|
|                                          | A                 | B    | C    | D    |
| Hi-milan 1855 *6                         | 35                | 15   | 0    | 15   |
| Hi-milan 1705 *7                         | 20                | 25   | 10   | 30   |
| Hi-milan 1706 *8                         | 45                | 60   | 90   | 20   |
| Hi-milan 1555 *9                         | 0                 | 0    | 0    | 25   |
| Titanium dioxide (TiO <sub>2</sub> )     | 1.0               | 1.0  | 1.0  | 1.0  |
| Flexural stiffness (Kg/cm <sup>2</sup> ) | 1700              | 2300 | 3200 | 1900 |

\*6: Hi-milan 1555 (trade name), ethylene-methacrylic acid copolymer ionomer resin obtained by neutralizing with sodium ion, manufactured by Mitsui Du Pont Polychemical Co., Ltd.

\*7: Hi-milan 1605 (trade name), ethylene-methacrylic acid copolymer ionomer resin obtained by neutralizing with sodium ion, manufactured by Mitsui Du Pont Polychemical Co., Ltd.

\*8: Hi-milan 1705 (trade name), ethylene-methacrylic acid copolymer ionomer resin obtained by neutralizing with zinc ion, manufactured by Mitsui Du Pont Polychemical Co., Ltd.

\*9: Hi-milan 1706 (trade name), ethylene-methacrylic acid copolymer ionomer resin obtained by neutralizing with zinc ion, manufactured by Mitsui Du Pont Polychemical Co., Ltd.

Table 4

|                                  | Example No. |           |           |           |           |
|----------------------------------|-------------|-----------|-----------|-----------|-----------|
|                                  | 1           | 2         | 3-1       | 3-2       | 4         |
| Core                             | Example 1   | Example 2 | Example 3 | Example 3 | Example 4 |
| Cover composition                | B           | B         | A         | D         | B         |
| Physical properties of golf ball |             |           |           |           |           |
| Weight(g)                        | 38.50       | 38.50     | 38.50     | 38.50     | 38.60     |
| Specific gravitiy                | 0.951       | 0.953     | 0.952     | 0.952     | 0.954     |
| Compression                      | 74          | 81        | 79        | 80        | 79        |
| Durability                       | 99          | 97        | 100       | 99        | 98        |
| Shoot feel                       | ○           | ○         | ○         | ○         | ○         |

Table 5

|                                  | Comparative Example No. |                        |                       |
|----------------------------------|-------------------------|------------------------|-----------------------|
|                                  | 1                       | 2                      | 3-1                   |
| Core                             | Comparative Example 1   | Comaparative Example 2 | Comparative Example 3 |
| Cover composition                | C                       | A                      | B                     |
| Physical properties of golf ball |                         |                        |                       |
| Weight(g)                        | 38.40                   | 38.50                  | 38.40                 |
| Specific gravitiy                | 0.953                   | 0.954                  | 0.957                 |
| Compression                      | 80                      | 85                     | 100                   |
| Durability                       | 60                      | 98                     | 97                    |
| Shoot feel                       | ○                       | x                      | x                     |